Ecological Response Units – Ecosystem Mapping System for the Southwest US

J. C. Moreland, W. A. Robbie, F. J. Triepke, E. H. Muldavin, and J. R. Malusa

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Objectives

- What are Ecological Response Units?
- What is the difference in existing vegetation vs ecosystem mapping?
- Discussion of the process of creating an ecosystem mapping product for resource management
- Lessons learned
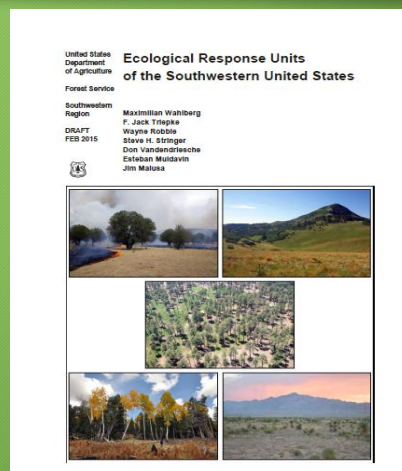
Why are we doing this?

- Natural Resource Management
  - Ecological Assessment of vegetation composition, structure, and process as influenced by past and present conditions, and future trends.
  - Creating a picture of "Then vs Now" to help shape recommendations towards informing a need for change within land management decisions.
  - Facilitates vegetation patch analysis
  - Wildfire Probability Analysis
  - Foundation for implementation monitoring
- Forest, Landscape, Habitat restoration projects
- Regional All-Lands Wildfire Risk Assessment
- Useful in modeling and landscape level analyses

What are Ecological Response Units (ERUs)?

Ecological Response Units facilitate landscape analysis and planning. The framework represents all major ecosystem types of the southwest region, and represents a stratification of biophysical themes.

United States Department of Agriculture

Ecological Response Units of the Southwestern United States

Forest Service

Southwestern Region

Maximilian Wahlberg
F. Jack Triepke
Wayne Robbie
Steve H. Stringer
Don Vandendriesche
Esteban Muldavin
Jim Malusa

DRAFT
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What are Ecological Response Units (ERUs)?

Ecological Response Units (ERUs) are map unit constructs, technical groupings of finer vegetation classes. The suite of vegetation classes that make up any given ERU share similar disturbance dynamics, plant species dominants, and theoretical succession sequence (potential vegetation).
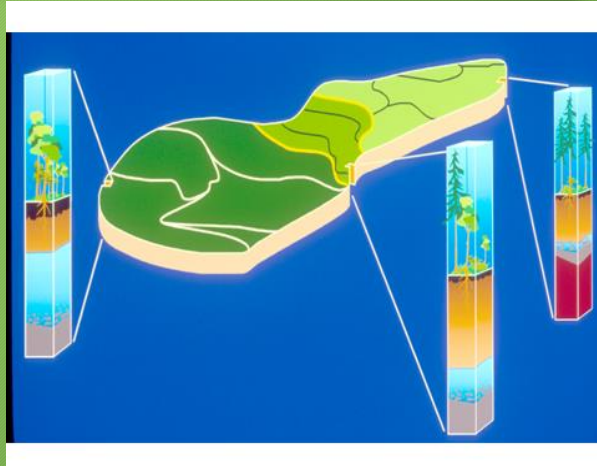
Ecosystem Mapping vs Existing Vegetation

- ERUs are used to define Historic/Reference Conditions within a mapping unit by integrating:
  - Site potential (soil physical and chemical properties, geology, geomorphology, aspect, slope, climate variables, geographic location)
  - Fire regime (historic and contemporary)
  - Neighboring vegetation communities
  - Seral state sequence
- Existing Vegetation = What's out there now

ERU: potential natural vegetation with disturbance

= Gambel Oak Shrubland ERU

+ Fire regime II
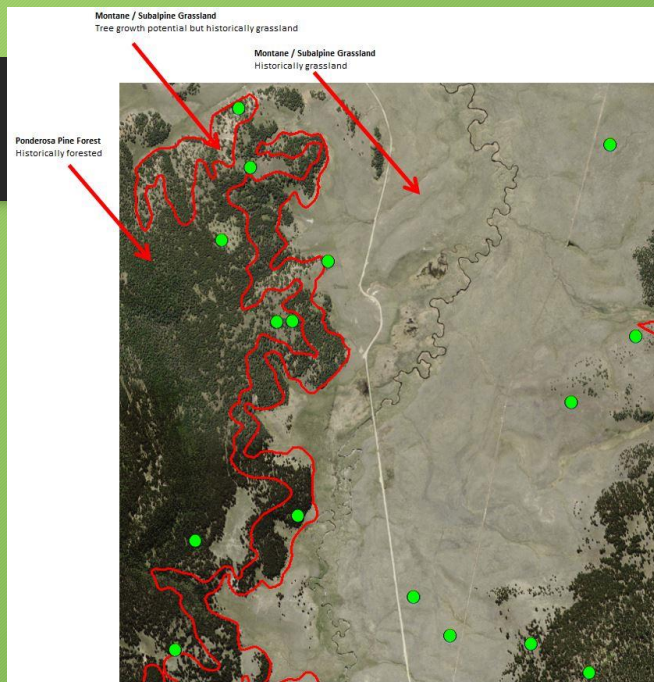
Site Potential

+ Fire Regime I

= Ponderosa Pine Forest ERU

Montane / Subalpine Grassland
Tree growth potential but historically grassland

Montane / Subalpine Grassland
Historically grassland

Ponderosa Pine Forest
Historically forested

EXISTING VEGETATION
Dominance type – *Quaking aspen*
Size class – *Small (5-10")*
Canopy cover – *Open (30-60%)*

ECOLOGICAL RESPONSE UNIT
Spruce-Fir Forest

A collaborative project

- Resource Specialists from various program areas
  - Fuels
  - Vegetation Ecology
  - Soil Science
  - Geographers
- Specialists from various administrative levels of the Forest Service
  - Ranger Districts
  - Forest Supervisor's Office
  - Regional Office
- Specialists from outside of the agency
  - Universities

Initial Project Scope

- Start with previous version ERUv4
- Add in new Terrestrial Ecological Unit Inventory (TEUI) survey data
- Add in corrected data from collaborative assessment made by University of AZ Ecologist Jim Malusa
- Identify anomalous attribution of ERU types using Climate Gradient and correct for most appropriate ERU type
- Product = ERUv5

Climate Gradients of the Southwest

High Sun Cold	
Low Sun Cold	
High Sun Mild	
Low Sun Mild	
Semi-Arid	
Subhumid	
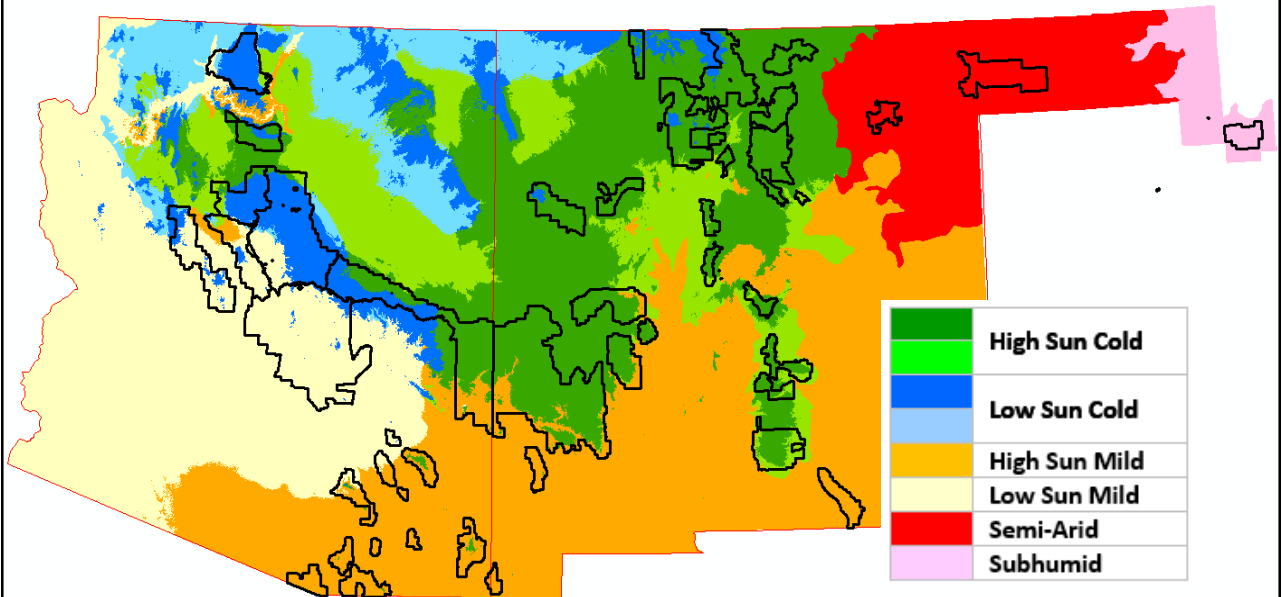
Actual Data inputs

- Terrestrial Ecological Unit Inventory (TEUI)-Field survey data-National Forest System (NFS) lands
- ERUv4 Climate Gradient Corrections-All lands
- Univ. of AZ Ecologist Jim Malusa ERUV4 Review-Selected lands in SE AZ
- ERU corrections using SW Biotic Communities and climate gradient percentages-all lands
- Integrated Landscape Assessment Project (ILAP)-Remote sensing product-all lands
- Regional Riparian Mapping Project (RMAP)-Riparian corridors in AZ and NM-all lands
- ERU subclass updates from ILAP grid analysis-all lands
- Neighbor analysis corrections

The need for standards

Proposed Standard Schema for ERUv5

1/6/2016

Field Name	Field Type	Field Length
r3ERU	Text	100
r3ERUcode	Text	10
r3ERUsubcl	Text	100
r3ERUsubclcode	Text	10
Prov_SubCl	Text	100
SystemType	Text	25
Source	Text	25
TEUI_MUs	Text	10

Any specific data trait can be queried out using the above outlined standardized data schema. Additional fields could be added in the future if required. A tabular example might look like the following given this input of information:

Semi-Desert Grassland – Foothills Grassland in a high sun mild climate gradient from TEUI:

r3ERU	r3ERUcode	r3ERUsubcl	r3ERUsubclcode	Prov_SubCl	SystemType	Source	TEUI_MUs
Semi-Desert Grassland	SDG	Semi-Desert Grassland – High Sun Mild	SDGhsm	Foothills Grassland (FHG)	grassland	TEUI	324

Cells without Value

All cells will contain values under one of three scenarios:

1. Actual value – The cell contains the known/actual value for the field, as in the example for Semi-Desert Grassland above.
2. Not applicable – The cell contains the term 'n/a' to denote a field that does not apply. For example, to date subclasses have not been identified for the PJ Sagebrush ERU and fields for subclass and provisional subclass would have the value 'n/a'.
3. Missing data – When the cell should contain a value for a given field, but the information is not known, the cell value is 'missing data'. For the field "r3ERUsubclcode" the value will be 'missing d*' due to field length restrictions.

Data crosswalks

OBJECTID *	r3ERU	r3ERUcode	r3ERUsubcl	r3ERUsubclcode	Prov_SubCl	SystemType	Source	TEUI_MUs *	Dist_No	MU_Numeric	xwalk_link *
904	Spruce-Fir Forest	SFF	Spruce-Fir - Lower	SFM	<Null>	forest	CIB_TEUI	668	<Null>	<Null>	<Null>
905	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	CIB_TEUI	669	<Null>	<Null>	<Null>
906	Montane / Subalpine Grassland	MSG	<Null>	<Null>	<Null>	grassland	CIB_TEUI	3	<Null>	<Null>	<Null>
907	Montane / Subalpine Grassland	MSG	<Null>	<Null>	<Null>	grassland	CIB_TEUI	10	<Null>	<Null>	<Null>
908	Sagebrush Shrubland	SAGE	<Null>	<Null>	<Null>	shrubland	CIB_TEUI	11	<Null>	<Null>	<Null>
909	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	155	<Null>	<Null>	<Null>
910	Ponderosa Pine Forest	PPF	Ponderosa Pine/Bunchgrass	PPG	<Null>	forest	CIB_TEUI	156	<Null>	<Null>	<Null>
911	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	157	<Null>	<Null>	<Null>
912	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	159	<Null>	<Null>	<Null>
913	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	CIB_TEUI	184	<Null>	<Null>	<Null>
914	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	CIB_TEUI	185	<Null>	<Null>	<Null>
915	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	189	<Null>	<Null>	<Null>
916	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	190	<Null>	<Null>	<Null>
917	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	193	<Null>	<Null>	<Null>
918	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	CIB_TEUI	196	<Null>	<Null>	<Null>
919	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	CIB_TEUI	197	<Null>	<Null>	<Null>
920	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	CIB_TEUI	198	<Null>	<Null>	<Null>
921	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	253	<Null>	<Null>	<Null>
922	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	CIB_TEUI	255	<Null>	<Null>	<Null>
923	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	275	<Null>	<Null>	<Null>
924	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	301	<Null>	<Null>	<Null>
925	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	CIB_TEUI	302	<Null>	<Null>	<Null>
926	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	311	<Null>	<Null>	<Null>
927	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	CIB_TEUI	312	<Null>	<Null>	<Null>
928	Montane / Subalpine Grassland	MSG	<Null>	<Null>	<Null>	grassland	CIB_TEUI	505	<Null>	<Null>	<Null>
929	Colorado Plateau / Great Basin Grassland	CPGB	<Null>	<Null>	<Null>	grassland	KAI_TEUI	3	<Null>	<Null>	<Null>
930	Montane / Subalpine Grassland	MSG	<Null>	<Null>	<Null>	grassland	KAI_TEUI	11	<Null>	<Null>	<Null>
931	Colorado Plateau / Great Basin Grassland	CPGB	<Null>	<Null>	<Null>	grassland	KAI_TEUI	255	<Null>	<Null>	<Null>
932	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	KAI_TEUI	257	<Null>	<Null>	<Null>
933	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	KAI_TEUI	260	<Null>	<Null>	<Null>
934	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	KAI_TEUI	261	<Null>	<Null>	<Null>
935	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	265	<Null>	<Null>	<Null>
936	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	266	<Null>	<Null>	<Null>
937	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	275	<Null>	<Null>	<Null>
938	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	276	<Null>	<Null>	<Null>
939	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	282	<Null>	<Null>	<Null>
940	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	283	<Null>	<Null>	<Null>
941	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	284	<Null>	<Null>	<Null>
942	PJ Woodland	PJO	PJ Woodland - Cold	PJOc	<Null>	woodland	KAI_TEUI	287	<Null>	<Null>	<Null>
943	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	290	<Null>	<Null>	<Null>
944	Ponderosa Pine Forest	PPF	Ponderosa Pine/Gambel Oak	PPO	<Null>	forest	KAI_TEUI	291	<Null>	<Null>	<Null>
945	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	KAI_TEUI	605	<Null>	<Null>	<Null>
946	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	KAI_TEUI	606	<Null>	<Null>	<Null>
947	Mixed Conifer - Frequent Fire	MCD	<Null>	<Null>	<Null>	forest	KAI_TEUI	615	<Null>	<Null>	<Null>
948	Spruce-Fir Forest	SFF	Spruce-Fir - Lower	SFM	<Null>	forest	KAI_TEUI	628	<Null>	<Null>	<Null>

The build: A hierarchy of data layers

- RMAP
- TEUI
- Univ of AZ / Climate Gradient / SWBC Eval
- ILAP
- ERU Version 4

Workflow

Ecological Response Unit Version 5 Workflow

Phase 1: Data Preparation

Phase 2: Data Assembly

Phase 3: QA/QC, Review, and Finalizing Data
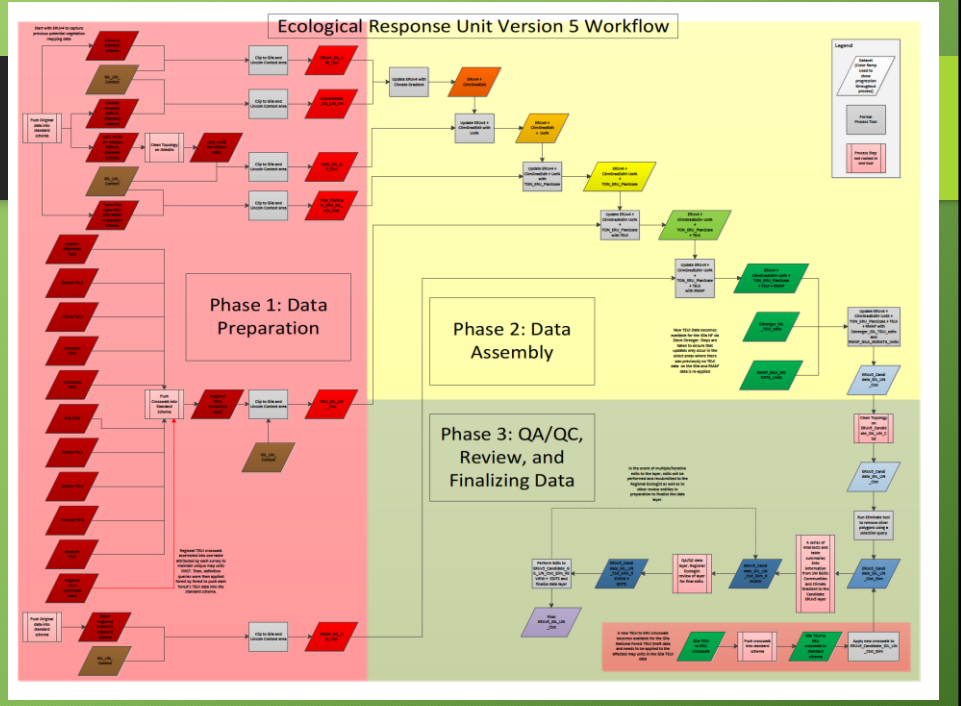
The product

- Northern and southern products developed separately and independently
- Each evaluated independently
- Joined together via "load" 876,000 features (Single part)
- Additional QA/QC performed afterward
- Released as Beta version
- Corporate version in process and release to public and partnerships coming soon
- Maintenance schedule to incorporate additions and edits to enhance product accuracy and to maintain relevance
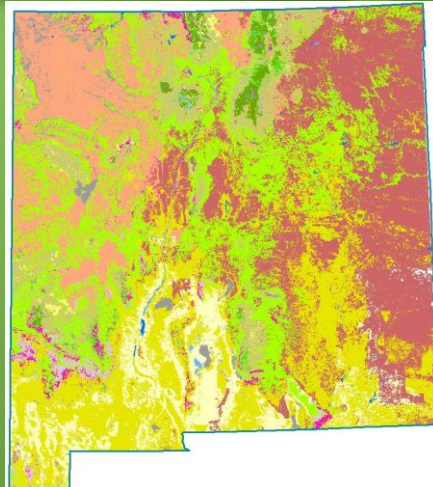
Lessons learned

- Time consuming CPU/processor intensive processes
  - 64 bit background geoprocessing
- Create standards early in the process
- Establish a master crosswalk that everyone works with
- Build QA/QC reviews into the process frequently
  - Local level reviews by specialist at the forest
    - Field going personnel with on the ground knowledge weigh in
    - TEUI Surveyors contribution
  - Regional level reviews by specialists at the Regional Office
    - Special review product with analysis metrics
    - Multiple summaries to catch inconsistencies in attribution
- Make no assumptions about how topologically 'clean' your input data is
- If the project is on a set timeline (Forest Plan Revision), establish hard deadlines for review and edits
- GIS and Specialists MUST communicate and learn from one another to understand

Questions